NOTICE OF MEETING AND CALL FOR ABSTRACTS

25TH PLANT DEVELOPMENT WORKSHOP

OCT. 27TH 1990

THE UNIVERSITY OF GUELPH

Room 442 University Centre

Hosted by Dr. Larry Peterson and Dr. U. Posluszny (Dept. of Botany)
Dr. Jean Gerrath (Horticultural Science)

Preliminary Program:

Registration (Rm. 441).....8:30-9:00am
Contributed Papers (Rm. 442).....9:00am-12:00pm
Lunch (Univ. Centre) and Posters (Rm.441).....12:00-2:00pm
Contributed Papers (Rm. 442).....2:00-3:00pm
Keynote Address by Dr. Judy Strommer (Plant Mol. Biol. & Dev.)...3:00pm
Wine and Cheese Reception, Faculty Club (Univ. Ctr., 5th Fl.).....4:00pm

Please note the abstract form enclosed: Return the form no later than **Oct. 5th**
Please note whether you are giving an oral or poster presentation.

We would also like to know how many people are coming and how many intend to stay for the reception at 4pm. Please send me a note with the number coming from your lab. Address all correspondence to:

Dr. U. Posluszny
Interim Chair,
Department of Botany
University of Guelph
Guelph, Ontario
N1G 2W1

ABSRACT FORM

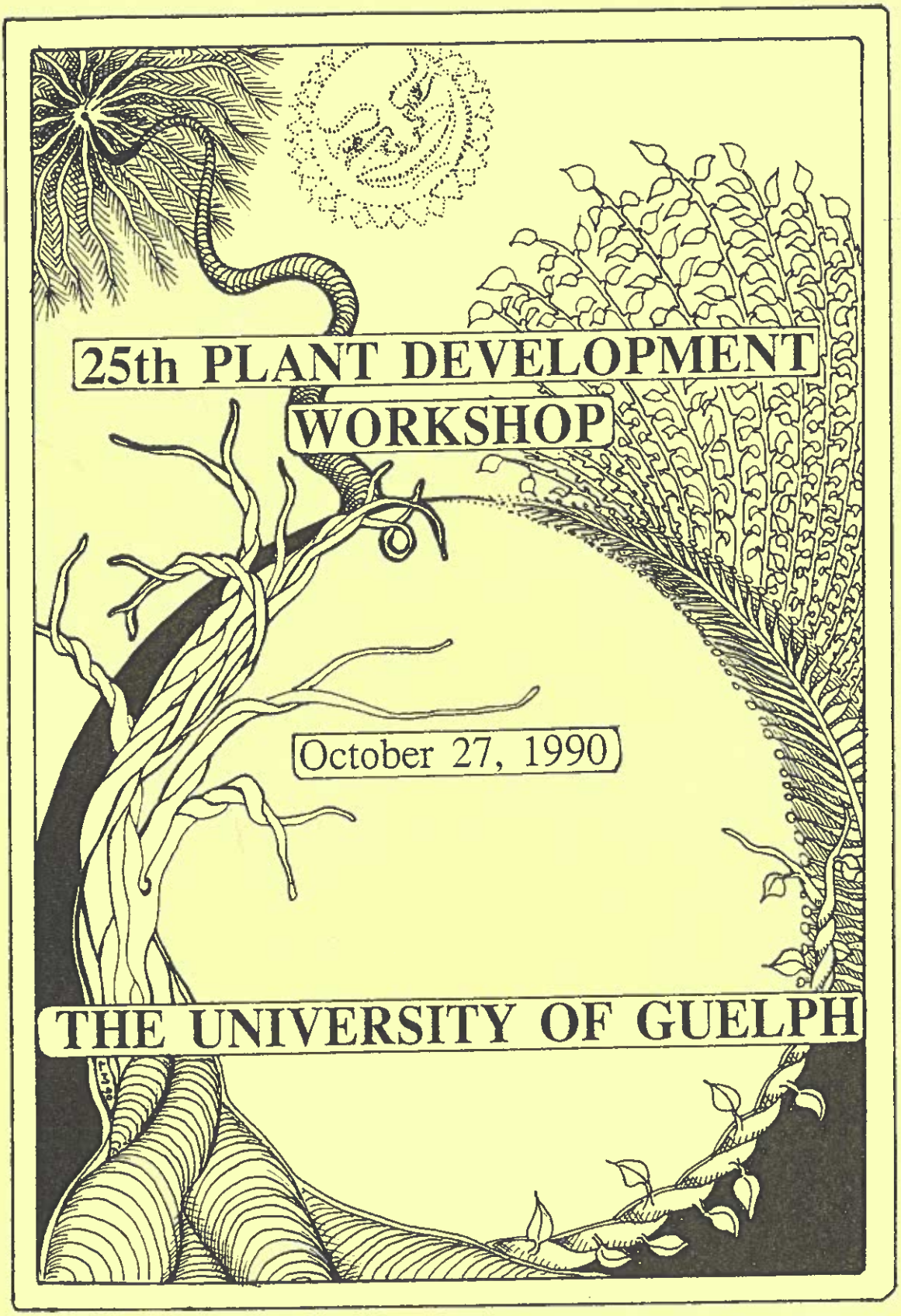
25TH PLANT DEVELOPMENT WORKSHOP
THE UNIVERSITY OF GUELPH
OCT. 27TH 1990

THIS FORM MUST BE RECEIVED BY OCT. 5, 1990.

MAIL TO: DR. U. POSLUSZNY, Interim Chair, Dept. of Botany, Univ. of Guelph, Guelph, Ontario, N1G 2W1

Read all instructions before typing or using a laser printer.

1. Rule a practice box on plain paper 7 x 4 inches. Compose abstract to fit within this area.
2. Indent author(s), address(es) and title. Start abstract at far left margin on next line. LEAVE NO BLANK LINES.
3. Author(s): first or single author put last name first, others first name first. give full first name of person presenting paper. End with a period.
4. Follow author(s) immediately with address(es), including postal code(s). End with a period.
5. Type a dash before title of abstract (still indenting). Capitalize only the first letter of first word in title, except for proper nouns, etc. Underline the full title (words and spaces).
6. Start text on the next line without indentation using entire width of box. Do not leave any blank lines in entire abstract. Type entire abstract within retangular box, and do not type on or beyond bottom of the box.
7. Use laser printer or electric typewriter with elite type. Single space all typing. Type perfect copy. DO NOT ERASE. The abstract will appear exactly as you submit it.
8. DO NOT FOLD THIS SHEET. Mail original and one xeroxed copy in a flat 9 x 12 inch envelope with cardboard backing.


25th PLANT DEVELOPMENT
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PROGRAM

MORNING - Dr. Jean Gerrath, Chair

9:00 Floral diversity and comparative floral ontogeny in *Agalinis* and relatives (Scrophulariaceae). **Judith Canne-Hilliker.**

9:20 An overview of the interactions between fungi and the exodermis in angiosperm roots. **Carol A. Peterson & Susan A. Kamula.**

9:40 Multivariate analysis in process morphology of plants. **Bernard Jeune & Rolf Sattler.**

10:00 Comparative studies of floral development in several genera of the Araceae with perfect flowers. **Robin W. Scribailo & P. Barry Tomlinson.**

10:20 BREAK AND POSTERS

11:00 Cytological changes induced by wheat streak mosaic virus in wheat leaf tissues. **Jian-Guo Gao & A. Nassuth.**

11:20 The reorganization of the cytoskeleton during induction of embryogenesis from microspores of *Brassica napus* cv. Topas. **Daina H. Simmonds.**

11:40 LUNCH AND POSTERS

AFTERNOON - Dr. Usher Posluszny, Chair

2:00 Localisation and seasonal changes of furanocoumarins on the surfaces of the leaves of Umbelliferous plants. **A.M. Zobel, Stewart A. Brown & K. Glowniak.**

2:20 Homology of peanut peroxidases. **Xiaohong Zheng & R.B. van Huystee.**

2:40 The use of *in situ* hybridization to study plant cell differentiation. **Nancy G. Dengler & Ronald E. Dengler.**

3:00 **KEYNOTE ADDRESS** - Introduction - Dr. Larry Peterson
Analysis of a gene and its expression: *Petunia Adh1*. **Judith Strommer & R. Gregerson.**

4:00 **Wine & Cheese Reception, Faculty Club (5th floor, U.C.)**

Canne-Hilliker, Judith. Department of Botany, University of Guelph, Guelph, Ontario N1G 2W1.-Floral diversity and comparative floral ontogeny in Agalinis and relatives (Scrophulariaceae).

Diversification of floral structure is a manifestation of angiosperm evolution responsible in large measure for variations in breeding systems among taxa, and is one of the factors influencing speciation. Relatively little is known about the aspects of ontogeny that generate floral diversity among closely related taxa. Systematic studies of Agalinis Raf. (purple false foxgloves) have led to a new classification within the genus and have presented questions best approached through studies of floral development. Interest centers on characterization of the ontogenetic events that result in the floral forms (1) characteristic of the various species groups (sections) within Agalinis, and (2) those suited to various pollinators (small and large bodied bees and hummingbirds) as well as those which are self-pollinated. Plesiomorphic and apomorphic floral types are identified and these will be compared developmentally. There are at least two homoplasious floral forms in the genus involving eight species. Sets of species are being studied for both floral forms to determine if the floral forms of independent origin develop similarly or if similar forms arise via different modes. The developmental morphologies of several species in the closely related Aureolaria and Brachystigma have been investigated to determine which gross aspects of floral ontogeny characterize the genera and which occur in all genera.

PETERSON, CAROL A. AND SUSAN A. KAMULA
Department of Biology, University of Waterloo, Waterloo, ON, Canada N2L 3G1.
- An overview of the interactions between fungi and the exodermis in angiosperm roots.

The exodermis, a hypodermis with a Casparian band, is present in roots of the majority of angiosperm species studied. However, this structure should have a negative impact on the uptake of water and ions. It is interesting to speculate that this layer is beneficial to plants because of its interactions with microorganisms. There are, at present, a few observations which indicate the potential significance of the exodermis in this role. (1) Roots collected from perennial plants in the field often have a dead and decaying epidermis. The exodermis, as well as the underlying cortex, is not infected. (2) In Eucalyptus pilularis, the ectomycorrhizal Hartig net extends only around the epidermis. The exodermis forms an apoplastic barrier on the root side and the pigmented fungal mantle forms another on the outside. These two barriers delineate a compartment in which exchange of substances between the fungus and plant occurs. (3) The endodermis and exodermis circumscribe an apoplastic compartment for the exchange of substances between VAM fungi and cortical cells. (4) Brammall and Higgins reported that fungal infection of tomato roots was delayed by the suberized exodermis. (5) Gallaud and more recently Blain Hussey and Larry Peterson found that the dimorphic exodermis has some unsuberized short cells which allow VAM fungi to enter. (6) Pathogenic fungi apparently make use of the short cell entry route as well. Gallaud reported that Fusarium penetrated roots through the short cells and Susan Kamula also found that Fusarium culmorum enters asparagus roots through the short cells. Shishkoff found that Pythium coloratum enters onion roots preferentially through short cells and unsuberized long cells.

Jeune, Bernard and Rolf Sattler. Phytologie quantitative, Université Pierre et Marie Curie, 75252 Paris, Cedex 05, France, and Biology Department, McGill University, Montreal, Quebec H3A 1B1. – Multivariate analysis in process morphology of plants.

According to process morphology, form is process. This process is analyzed in terms of thirteen parameters (variables) of growth. The values of these parameters, which are quantified, represent specific processes such as determinate or indeterminate growth, radial or dorsiventral growth, branching or lobing, etc. Any particular structures such as a thallus, a telome, a stem, or a leaf is seen as a specific combination of the specific processes. Process combinations representing a wide variety of typical and atypical or controversial structures of flowering plants as well as typical structures of other plant groups (a thallus, a telome, an enation, a microphyll and megaphylls) were selected. Discriminant analysis and principal component analysis were then used to quantitatively determine the relations of these process combinations. The general picture that emerged is a patterned continuum. The pattern is due to the fact that some regions of the continuum are much denser than others, i.e., they are occupied by a greater number of process combinations. The dense regions are those process combinations representing the structural categories root, stem/shoot, leaf, trichome as well as thallus, telome and others. The proposed approach could be used to establish evolutionary change in the pattern of process combinations. It also provides the basis for phylogenetic reconstruction if one agrees that phylogeny is a change in the dynamics of successive ontogenies.

SCRIBAILO, ROBIN W.* AND P. BARRY TOMLINSON. Harvard Forest, Harvard University Petersham MA 01366. -Comparative studies of floral development in several genera of the Araceae with perfect flowers.

Although the Araceae are well characterized by the constant inflorescence type consisting of a fleshy spadix enveloped by a spathe the family exhibits extensive diversity in the structure of individual flowers and inflorescences. Although floral structure is of importance in the classification of the aroids, studies of floral development are very limited. Of interest are developmental modifications culminating in the evolution of unisexual flowers from hermaphrodite flowers. As a first step towards understanding the expression of floral diversity in the family we have initiated a study of floral development in several genera of the family with perfect flowers including, Acorus, Pothos, Gymnostachys and Calla. Floral parts develop in dimerous or trimerous whorls with mery often varying on the same spadix. Two whorls of tepals and stamens are followed by a gynoecium having from one to three carpels. Floral development in Acorus indicates that the purported bract subtending individual flowers is actually the abaxial member of the inner tepal series which develops precociously. Of particular interest in Calla was evidence of, the initial development but subsequent arrest of perianth members in some flowers, and more complex inflorescence structure with spadices consisting of aggregates of highly condensed cincinnal branches. Although the flowers in Calla are initiated in a cymose sequence, they eventually all mature at the same time, obscuring their mode of origin. These observation of complex inflorescence organization represent the first report of inflorescence structure other than a simple spike in the Araceae and may have considerable evolutionary implications. Results suggest both considerable diversity and plasticity in the development of perfect flowers in the Araceae.

GAO, JIAN-GUO, and A. NASSUTH. Department of Botany, University of Guelph, Guelph, Ont. N1G 2W1. Cytological changes induced by wheat streak mosaic virus in wheat leaf tissues.

Cytological changes induced by wheat streak mosaic virus in wheat leaf tissues were studied at the light microscope level. Starting 4-5 days after inoculating the first leaves, a number of cylindrical inclusions were present in the concentrated cytoplasm of the second leaf epidermal cells. At later stages of infection these inclusions formed massive, irregular aggregates. Amorphous inclusions could also be identified in the epidermal cells at late infection stages (from 10 days post inoculation), often associated with deformed nuclei. In mesophyll cells, virus infection induced a condensation of the cytoplasm, including chloroplasts, around enlarged, disrupted nuclei. In addition, the cell walls increased in thickness due to a deposit which was identified by differential staining as a phenolic compound but not lignin, suberin or callose. Approximately 11 days post-inoculation, the mesophyll cells collapsed. This was not observed in either naturally senesced virus-free mesophyll cells, or virus-infected epidermal cells. Bundle sheath cells showed less collapse than mesophyll cells. The groups of mesophyll cells with virus-induced changes correlate with the discontinuous streak mosaic symptom typical for wheat streak disease.

Simmonds, Daina H.
Plant Research Centre, Agriculture Canada, Ottawa, Ontario K1A 0C6.
- The reorganization of the cytoskeleton during induction of embryogenesis from microspores of Brassica napus cv. Topas.

Cultured microspores of Brassica napus cv. Topas produce embryos at high frequencies. Isolated, late uninucleate microspores will differentiate into embryos at 25°C provided that they are first subjected to an induction temperature of 32.5°C for at least 18 hours. Without the temperature induction, the microspores continue to develop as pollen. The switch from microgametogenesis to embryogenesis is accompanied by a marked change in the organization of the cytoskeleton from gametic to somatic patterns. Non-embryogenic lines of B. napus do not show a change in the cytoskeleton when subjected to the temperature treatment. The cytoskeletal changes and associated signals during induction are under investigation.

LOCALISATION AND SEASONAL CHANGES OF FURANOCOUMARINS ON THE SURFACES OF THE LEAVES OF UMBELLIFEROUS PLANTS

A.M. Zobel[1], Stewart A. Brown[1], and K. Głowniak

1. Chemistry Dept., Trent University, Peterborough, Ont. Canada K9J 7B8
2. Dept. of Pharmacognosy and Technological Laboratory, 12 Pstrowskiego Street, 20-007 Lublin, Poland

A number of furanocoumarines of some medicinal plants known as causing photodermatidis was proved to exist on the leaf surface (1). Some furanocoumarins (xanthotoxin, bergapten) are noted as a phytoalexins accumulated in the parsnip roots infected by a fungus (2).

In the present work the localisation of the three dominant furanocoumarins (xanthotoxin, bergapten, and imperatorin) on the leaf surfaces of Angelica archangelica, Pastinaca sativa Apium graveolens, and Levisticum officinale was examined. A racently developed method for the removing of surface furanocoumarins deposits by dipping the plant organs into hot water (96°C) for 1-2 sec. was followed by sample purification and HPLC analysis (3).

The developmental changes in the concentration of furanocoumarins during the year and changes due to influence of the environment were observed. The large amounts of furanocoumarins (60-70% of the total in the plant) were extractable into boiling water, indicating their localisation on the cuticale. Xanthotoxin was usually present in the highest concentration on the surface of the leaves (Angelica archangelica, Pastinaca sativa, Apium Graveolens). It presumable plays an important role in the plant's defense system as the first barrier against bacteria, fungi.

Homology of peanut peroxidases.

Xiaohong Zheng & R.B. van Huystee, Dept. of Plant Sciences, U.W.O.

It is the intent of this report to associated either anionic or cationic peroxidase isozymes with the fractions extracted from the cell wall and cytoplasm of culture cells. Once this has been achieved a further functional studies will be undertaken using the readely purified peroxidases from the medium. Through the means of Ouchterlony gel diffusion, Western blot and competitive ELISA it was determined that the cell wall fractions were largerly represented by the major cationic peroxidase isolated from spent medium of peanut cells. Conversely the cytoplasmic -or soluble cell fraction was mainly represented by the anionic isozyme isolated from that medium. The ELISA values indicated >80% similarity between the medium isozymes and the cell fractions.

Dengler, Nancy G. and Ronald E. Dengler. Department of Botany, University of Toronto, Toronto, Ontario M5S 3B2 and Life Science Division, Scarborough Campus, University of Toronto, Scarborough, Ontario M1C 1A4. - The use of in situ hybridization to study plant cell differentiation.

In situ hybridization enables the precise localization of cells containing a specific nucleic acid sequence in a manner analogous to immunological localization of cells containing a particular protein. It involves the hybridization of a nucleic acid probe with a specific target nucleic acid within a tissue section. Potentially, at least, detection of very rare messenger RNAs is achievable because of complementary base pairing between a nucleic acid probe and its mRNA target. We are both interested in the patterns of bundle sheath and mesophyll differentiation in plant species with C4 photosynthesis, and a major goal of our recent sabbatical leaves at the Australian National University was to learn this methodology to apply to studies of cell differentiation during leaf development. After many trials and tribulations, we had moderate success with localizing mRNA for the small subunit of rubisco and for rubisco activase in C3 and C4 species of Atriplex. We will present our results and discuss the potential and problems of in situ hybridization for plant development.

Strommer, Judith and R Gregerson. Dept. of Horticultural Science, U. of Guelph, Guelph, Ont. N1G 2W1 and Dept. of Genetics, U. of Georgia, Athens, GA, 30602. - Analysis of a gene and its expression: *Petunia Adh1*

One of the best-studied plant genes is that encoding alcohol dehydrogenase in maize, largely because of its involvement in the response of plant rootlets to anaerobic stress. There is evidence that, under anaerobic conditions, expression of this gene is regulated via (1) transcriptional activation, (2) RNA stabilization and (3) preferential translation. Adh is also expressed at a very high level in developing anthers. To permit dissection of the mechanisms regulating levels of gene expression under anaerobic and developmental conditions, we have begun analyzing Adh gene expression in Petunia. I shall present the results we have obtained and describe the approaches we are using to analyze transcriptional and post-transcriptional regulation of the level of Adh RNA in Petunia.

Ockenden, Irene and John N.A. Lott. Department of Biology, McMaster University, Hamilton, Ontario, Canada, L8S 4K1. - Sensitivity of various phytates to beam damage during x-ray analysis as compared to the sensitivity of globoid crystal phytate analyzed under the same conditions.

Phytic acid salts (phytin) are stored in seeds and act as nutrient reserves of elements such as Mg, K, Ca and P. These reserves are often localized in electron dense spherical particles called globoid crystals located within protein bodies. Globoid crystals within isolated protein bodies of squash cotyledons (*Cucurbita maxima*) were analyzed at 25°C and at -160°C. While the globoid crystals sustained little visible damage during exposure to the electron beam, the peak-to-background ratios for potassium were consistently lower with the room temperature measurements than with measurements in the cold. To examine the problem of K loss further we analyzed a number of commercial phytates which had different monovalent and divalent cations. It was immediately apparent that the commercial phytates were more sensitive to beam damage than phytates making up the globoid crystals. Beam damage resulted in mounds formed at the site of analysis but no loss of K or Na was detected from the commercial phytates measured at room temperature. The visible damage to the phytate crystals was markedly reduced with analysis in the cold. The damage was also less if the crystals were dried prior to analysis. The differences in the responses to the beam between the globoid crystals and isolated phytate salts must be due to differences in the packaging of the phytate within the globoid crystals.

Skilnyk, H.R. and John N.A. Lott. Department of Biology, McMaster University, Hamilton, Ontario, Canada, L8S 4K1. - Loss of elements during thin sectioning of anhydrously fixed pollen.

Anhydrous fixations are not commonly considered as a means of preparing biological specimens for energy-dispersive x-ray EDX analysis. *Cucurbita maxima* and *Cucurbita andreana* pollen grains were fixed anhydrously because water-soluble materials such as potassium phytate are extracted by aqueous fixatives. Combining anhydrous fixation with anhydrous sectioning techniques demonstrated significant reduction in the extraction of K, Mg and P from globoid particles in the tube cell cytoplasm in pollen. Sections of anhydrously fixed pollen that were floated onto a microtome boat filled with distilled water had lower Mg, K, P and (Mg+K)/P peak-to-background ratios for globoid particles than did sections of the same material floated onto a microtome boat filled with ethanol. When calculated as a % loss of mean peak-to-background values, more than 60% of Mg and K, and more than 29% of P were extracted from sections floated onto water-filled microtome boats. The results showed that there could be a dramatic loss of elements from anhydrously-fixed pollen during thin sectioning.

Singh, Amarjit and A. Nassuth. Department of Botany, University of Guelph, Guelph, Ontario N1G 2W1, Canada. -Tomato spotted wilt virus: symptomatology, detection and molecular biology.

The tomato spotted wilt virus (TSWV) seriously affects the production of food and ornamental crops worldwide. TSWV is unique among plant viruses in that it is enveloped, difficult to identify by bioassays, transmitted by thrips and has a wide host range. We are interested in studying the symptomatology, the virus localization and the identification of virus- and host-encoded proteins induced in infected leaf tissue. The general symptoms of TSWV infection on Datura stramonium include chlorotic specks, necrotic and ring spots on leaves and wilting of the whole plant. Symptoms on Nicotiana tabacum cv. Samsun NN include necrotic spots and blotches on leaves and wilting of the whole plant. A press blot assay revealed that virus particles are not restricted to certain parts of the leaf. TSWV coat protein (30 kD) and a low molecular weight protein (14.5 kD), probably host-encoded, could be detected in extracts from D. stramonium leaf tissue. The presence of coat protein was confirmed by western blot analysis using TSWV polyclonal antibodies. Another putative viral structural protein (120 kD) could also be detected by radiolabelling. No protein modification could be observed in pulse-chase experiments. A search for the presence of host-encoded pathogenesis-related (PR) proteins with the antiserum for PR 1a was negative for TSWV-infected D. stramonium extracts.

Fife[1], Cheryl A., Daina H. Simmonds[2] and William Newcomb[1].
[1]Department of Biology, Queen's University, Kingston, Ontario K7L 3N6.
[2]P.R.C., Agriculture Canada, Bldg. #21, C.E.F., Ottawa, Ontario K1A 0C6.
-The use of cytological techniques to select buds for increased frequencies of microspore-derived embryos of Brassica napus cv. Topas.

In vitro techniques can alter the development of immature pollen grains so that haploid embryos, resembling zygotic embryos, are formed directly: a bypass of sexual reproduction. Initial studies showed Brassica napus cv. Topas (canola or rapeseed) microspores would produce embryos when subjected to a heat induction during initial culturing. In order to study the cell biology of this switch in development, high frequencies of embryogenesis are required. A culturing procedure has been developed to isolate a more synchronous population of microspores and to increase the frequency of embryogenesis. Buds in the 3.5 to 5.0 mm range were used to record the bud length and petal length. Following isolation of the microspores, a sample was used to stain nuclei with Hoechst 33258 and then to stage the microspores using nuclear and cytoplasmic characteristics. The remaining isolated microspores were cultured for 3 weeks to score for embryo number. Bud length and petal length could not be used to predict frequencies of embryogenesis. However, embryogenic frequencies were predictable when cytological parameters were used to stage buds. Frequencies of embryogenesis were improved from the previous range of 5 to 10% to a range of 10 to 30% Criteria used to determine the stage of development of microspores within a bud and the relationship to the frequency of embryo formation will be discussed.

Scales, P.F. and R.L. Peterson. Department of Botany, University of Guelph, Guelph, Ontario, N1G 2W1. - A structural analysis of two E-strain ectomycorrhizal associations.

The structure of ectomycorrhizae synthesized between the E-strain fungus, *Wilcoxina mikolae* var. *mikolae*, and two tree species is characterized. Host species were grown in plastic growth pouches and inoculated via plugs of fungal mycelium on agar. For both mycorrhizal types, mantle formation was visible on lateral roots within 10 days of inoculation. *Picea mariana* ectomycorrhizae had a very thin mantle. *Betula alleghaniensis* ectomycorrhizae had a more substantial mantle, consisting of several complete hyphal layers and several more incomplete layers. For both mycorrhizal types, the innermost mantle hyphae were embedded in mucigel on the root surface. A well-developed Hartig net with a labrynthic mode of growth occurred in both types of mycorrhizae. The cytoplasmic density of the intercellular hyphae was greatest towards the root apex. *B. alleghaniensis* ectomycorrhizae had a paraepidermal Hartig net and the root epidermal cells were radially elongate at an oblique angle. The Hartig net of *P. mariana* ectomycorrhizae penetrated all layers of the cortex.

KRAUS, TREVOR E., D.P.MURR[1] AND R.A. FLETCHER. Departments of Environmental Biology and Horticultural Science[1], University of Guelph, Guelph, Ontario, N1G 2W1. -Inhibition of ethylene biosynthesis by uniconazole.

Previous studies have shown that uniconazole impairs ethylene biosynthesis in mung bean and cucumber seedlings. This research was undertaken to delineate the mechanism of ethylene inhibition by uniconazole. Ethylene production and the conversion of exogenous 1-aminocyclopropane-1-carboxylic acid (ACC) to ethylene was not inhibited by uniconazole in excised soybean cotyledons. However, ethylene production from uniconazole-treated wheat (5.0mg/L) and soybean (0.4mg/L) seedlings was inhibited 32% and 48%, respectively. Under heat stress conditions ACC levels increased 40% in both the control and uniconazole-treated wheat seedlings. Five hours after herbicide application (4.4g/Ha a.i. Triclopyr) ACC levels increased 400% in both the control and uniconazole-treated soybean seedlings. The increased ACC levels, following stress, were accompanied by increased ethylene production in the control seedlings, but not in the uniconazole-treated seedlings. These results suggest that the observed decrease in ethylene production in uniconazole-treated seedlings is mediated by inhibition of the conversion of ACC to ethylene in young, non-senescing tissue.